occurs always, I think, at E, the cross-section of the bar being proportionately more reduced than the load.

ALEX. B. W. KENNEDY

University College, March 23

The Colours of Arctic Animals

THE white colour of Arctic mammals and birds has hitherto been generally ascribed by evolutionists to protective resemblance, the adaptation to a snow-covered country being attributed to the preservation of individuals which by assimilating to their environment in colour, either escaped detection by their foes, or, on the other hand, were by this means enabled to secure their prey more advantageously. Although a certain weight may, in the case of some species, be fairly given to these organic factors, it always appeared to me that this explanation was not in itself sufficient, in face of the consideration that many of the species so coloured could hardly be said to require such protection on account of persecution, or to derive any obvious advantage therefrom for predatory purposes. A more satisfactory explanation seemed to be that the mode of coloration in question had, at any rate in the first instance, been brought about by natural selection through physical rather than through organic agencies. It is well known that white, as the worst absorber, is also the worst radiator of all forms of radiant energy, so that warm-blooded creatures thus clad would be better enabled to withstand the severity of an Arctic climate—the loss of heat by radiation might, in fact, be expected to be less rapid than if the hairs or feathers were of a darker colour.[1] According to a paper recently published by Lord Walsingham,[2] it seems that this view was entertained as far back as 1846 by Craven,[3] the only addition to the theory required by modern evolution being that we must regard the white covering as having been acquired by the ordinary Darwinian process of the survival of the fittest, *i.e.* by the climatic selection of those individuals best fitted to withstand the extremely low temperatures of their habitat.

It is perfectly familiar to zoologists that most animals occasionally give rise to white varieties, so that the basic variations necessary for the establishment of the required modification in the colour of the hair and feathers would not have been wanting during the gradual approach of the Glacial Epoch. It may be conjectured whether white may not have been the prevailing colour among all warm-blooded animals during this period, with the exception, perhaps, of those species in which the severity of the climate may have been met by an equally effective thickening of the fur. Certain species which, like the stoat and ptarmigan, become white during winter, may, from this point of view, be regarded as reverting seasonally to the mode of coloration which in their ancestors was normal during the Glacial Epoch, the reversion being in these cases brought about by the same influences which formerly fixed white as the most advantageous form of covering. In accordance with this view, it is sometimes asserted that the stoat does not commonly turn white during winter in the south of England, excepting in very severe seasons.[4] Further observations on this point are much needed.

In striking contrast to the white covering of Arctic and Alpine mammals and birds, it has been found that there is a quite opposite tendency for the insects to become darker and more suffused, this melanism being especially noticeable among many of the Lepidoptera. Although numerous speculations as to the cause of this phenomenon have from time to time been advanced, it is in the paper by Lord Walsingham above referred to that what appears to be a true cause has for the first time been suggested. The author has, in fact, most ingeniously extended the very argument which had been adduced to account for the white colour of the mammals and birds to explain the quite opposite melanism of the insects. According to the present view the the melanic tendency of northern Lepidoptera must be ascribed to the natural selection of the darker forms owing to the advantage which these would possess in being able to absorb more of the solar radiation than their lighter congeners. The same action must be regarded as here bringing about opposite effects: in the case of warm-blooded animals the loss of heat by radiation is retarded by the white covering, whilst in insects, which develop but little heat by respiration, it is of the utmost importance to utilise as much as possible of the solar energy. This will be seen to be all the more necessary when it is considered that, under Arctic conditions, the solar rays have but little power, and that the pairing of the insects has to be effected with great rapidity. In order to test these views experimentally, the author exposed numerous species of Lepidoptera of various colours to the sun's rays on a surface of snow, and observed the rate at which the insects sank beneath the surface. As might have been anticipated, the darker insects, like *Tanagra chærophyllata*, sank more rapidly than white moths like *Acidalia immutata*, which made but little impression on the snow.

The questions raised by these suggestions and observations certainly appear to be well worthy of consideration when discussing the subject of animal coloration. Thus the explanation of the melanism of Arctic insects now advanced may perhaps, when more fully elaborated, throw further light upon the theory of seasonal dimorphism first proposed by Weismann.[1] If, in accordance with the views of this author, we regard the present winter forms of these seasonally dimorphic Lepidoptera as the ancestral Glacial types, it becomes clear why in such white species as *Pieris napi*, the parent Glacial form *Bryoniæ* should be the darker. In the case of *Araschnia levana* the theory does not at first sight apply, inasmuch as the winter form is lighter than the summer generation (*Prorsa*); here, however, both forms are coloured, and there would be but little difference in their relative heat-absorbing powers. The same remark may apply in the case of our own seasonally dimorphic species of *Selenia* and *Ephyra*.

R. MELDOLA

An Error in Ganot's "Physics"

IN your issue of February 19 (p. 361), E. Douglas Archibald calls attention to a typical error in Ganot's "Physics," 10th edition, p. 325, and assumed that it had run through the ten editions. If he had taken the pains to look back to previous editions the formula would have appeared right, viz.:—

$$P = \frac{0{\cdot}31\ V(H - \frac{3}{8}FE)}{(1 + \alpha t)\,760}.$$

In going over the text of earlier issues of the book some minor errors are discoverable, but do not detract materially from the value of the same to the careful student

FRANK E EMERY,
1st Asst. Sci. Dept.

Mountainville, Orange Co., New York, March 4

WITH reference to the letter of Mr. Frank E. Emery on mine, calling attention to the typical error in Ganot's "Physics," I beg to say that though in some of the earlier editions the error may not exist, it occurs in the 5th and 10th, both of which are in my possession. The inference is very strong that if it occurs in these two it occurs in the editions *intervening*, and thus in HALF of the editions published. The first five editions are now getting out of date, so it is not of much value to people if the error does not exist in them.

I would also observe that if Mr. Emery takes the pains of reading my letter over again he will notice it was explicitly stated to be for the benefit of the large class of students who are *not careful*.

My purpose was in no way to run down Ganot, but to warn people of a pitfall in it.

E. DOUGLAS ARCHIBALD

Tunbridge Wells, March 23

Exceptional Whiteness in Tropical Man

SINGULARLY enough, being encamped in the same place as that from which the paper on "The Blackness of Tropical Man" was written to NATURE some months ago, the converse, a case of the whiteness of this class of man, presented itself unexpectedly. While entering, to-day, the native village of Jeykondasholapurm, that had sunk to nothing from having been the capital of a native dynasty in the south of India, and situated about lat 11° N. and long. 78° E., the writer observed an apparently white woman sitting on a doorstep by the side of the road, with flaxen-coloured

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[1] *Trans. Essex Field Club*, vol. i. *Proc.*, March 20, 1880, p. vi.

[2] "On some probable causes of a tendency to melanic variation in Lepidoptera of high latitudes;" the Annual Presidential Address to the Yorkshire Naturalists' Union, Doncaster, March 3, 1885.

[3] "Recreations in Shooting," p. 101.

[4] R. M. Christy in *Trans. Essex Field Club*, vol. i. p. 67.

[1] I may take the present opportunity of pointing out to those who possess the English edition of the "Studies in the Theory of Descent" that an error inadvertently occurs in the numbering of the figures in Plate I. Figs. 2, 3, 4, and 5 should have been numbered respectively 3, 5, 2, and 4. I am indebted to Mr. E. B. Poulton for kindly calling my attention to this transposition.

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hair, but having in other respects the characteristics of natives attacked by leprosy. Making inquiries from one of the principal native revenue officials at the place, it was ascertained that there was a family living hardly a mile away, of which more than one of the members had been born, and continued, white all their lives. That this did not result from their being lepers, and that none of their neighbours were in the least afraid of them, though opinion was not quite clear as to the whiteness not being disease.

Losing no time, it did not take long to reach the hut in which this family of albinos were to be found. They are of the Hindu blacksmith caste. The father and mother are stated to be of the ordinary blackness of natives of India, but were not seen on this occasion. A son, aged twenty-two, was there working at his trade, with the white colour, features, and light flaxen hair of a European, the only difference being a coarseness of the texture of the skin, and a slightly vacant expression. There was, beside him, an apparently elder brother, quite dark, and a native Hindu in every respect. It was said that albinos had occasionally appeared in the family, one of the uncles, for instance, having been white.

On being questioned as to whether there was any difference between the albinos and ordinary natives, it was at once said that the former could not stand being in the sun, which reddened and inflamed the skin, upon which the remark fell from the writer that it would be worth while to transport such individuals to a cold climate, where they would he exposed to no inconvenience. And so it would, because there can be no doubt that one of these white Hindus, early taken, and educated in a European climate, would from palpable observation of the specimen now described be absolutely indistinguishable as a native of India.

Evidently some cause has interfered with the production of pigment in the cells of the skin, with the effect of rendering the albinos highly sensitive, and more so than a European, to the invisible heat rays of the spectrum, which are so injurious to the constitution in India.

The contrast between the faces of the brothers was peculiarly striking, for there was sufficient resemblance, in the lower part of the face especially, to show there was a distinct relationship—that of the one who was dark wore the ordinary mild composure; but the other, by the mere change of colour, had completely and inadvertently thrown off the Oriental mask; and it would be almost impossible to convey to any one, not seeing it exemplified, how vast a change could be made by so simple an alteration, displaying the way the real individuality of race is lurking in an extraordinary manner beneath a tropical blackness.

India, February 24 A. T. FRASER

Far-sightedness

THOUGH I have already published a note on the subject in a Dutch paper (*Tijdschrift van het Aardrijkskundig Genootschap*, February, 1885), perhaps you will kindly allow the following lines to have a place in NATURE, because those who are occupied in the trigonometrical survey of British India may take an interest in the matter, and be able to give more particulars about it.

In a paper on Mr. Whymper's travels in Greenland, which appeared in *Ausland*, t. xii., 1884, I found in a foot-note the following remark:—"The reader might be astonished on hearing that I [Mr. Whymper] could see a mountain at such a great distance (about 100 English miles); but I may add that the day before I saw two other mountains 40 and 150 English miles distant; with one exception this was the greatest distance at which I have ever been able to make out objects."

Since I have not found any other reports in which it is expressly stated that objects were seen at a greater distance, I presume I may allege my own experience. While occupied with the trigonometrical survey of Western Java I sometimes had an opportunity of seeing objects at a very great distance, though, under the circumstances I was in, I had no time to look for them on purpose.

The greatest distance at which the angular points of triangles of the first order were from each other was about 105 kilometres; no difficulty ever arose from the distance, and no difference was made whether signals or heliostats (square mirrors of about 3 inches side) were observed.

When on Gng Karang (Bantam) I made out Keizerspick (Sumatra) at a distance of more than 110 English miles, though not quite easily, the top just peeping out from the slopes of Sebesic; if there had been a signal on Keizerspick at that time I think I could have observed it.

The greatest distance at which I remember ever to have seen an object was noted during my stay on Gng Tjikoraij (Preanger Regentsch), when I made out Gng Merapi (Java) most distinctly at a distance of about 180 English miles[1] and I suppose that Gng Lawu was also visible (225 English miles distant), but I could not quite distinguish it from the group of mountains of which it is one. It is, of course, from high summits that objects are seen at the greatest distances, and objects which are more elevated at a greater distance than such as are close to the ground.

I think it would be interesting to gather experiences referring to the subject made in different climates and under different circumstances. EMIL METZGER

Stuttgart, March 23

Krakatoa

SUPPOSING that the underground noises heard at Caïman-Brac on Sunday, August 26, 1883, were not only synchronous with, but actually the same as, those caused by the great eruption in the Straits of Sunda, it does not seem to follow that the sound-waves were propagated through the whole diameter of the earth. On the contrary, the question is at once raised, at what depth below the surface did the disturbances occur which found such destructive vent at Krakatoa? And if only the time-record east and west were accurate and satisfactory, there would seem to be some datum supplied for approximately estimating this depth. The centre of disturbance may have receded from and become inaudible at the Caïmans in proportion as, on the 27th, it found final vent at Krakatoa. HENRY CECIL

Bregner, Bournemouth, March 30

The Recent Aurora

THE "Sunk" lightship is in electrical communication with the Essex coast, being connected thereto by a telegraphic cable 8·984 nautical miles in length, laid from Walton-on-the-Naze in an easterly direction. The electrical condition of this cable is ascertained daily at 10 a.m., by means of tests applied at the shore ends. Until the 15th inst. these tests were very regular and satisfactory, but on the morning of that day it was found to be impossible to obtain any satisfactory results, owing to electrical disturbances produced in the cable by some external influence. The electrician on board reported that the weather was very fine and summer-like, sea perfectly smooth, with variable light airs, and he could in no away account for the effects the electrician was observing on shore. Between 9 and 10 p.m. those on board the lightship observed in the northern sky a very brilliant aurora, from which at intervals two very bright columns extended upwards to the zenith, and there apparently joined.

I send you these particulars as they may be worth recording in connection with the aurora seen at Christiania on the same evening, and described by Mr. Sophus Tromholt in his letter to NATURE, published on the 26th inst. (p. 479). There can be no doubt but that the aurora seen at Christiania was identical with that noticed by the men on the lightship off Walton-on-the-Naze, and, although it was not visible until the evening, it was evidently affecting the electrical condition of the earth on the morning of that day, and was the direct cause of the electrical disturbance in the cable. Since that date the tests have been as satisfactory and regular as before. WILLOUGHBY SMITH

March 30

THE COSMOGONIC THEORY OF M. FAYE[2]

M. FAYE has expounded his theoretical views on cosmogony in the several publications named above, and in his book he has also treated of the historical development of cosmogonic theories. We shall in the present article confine our attention to that which is original in his speculation; and we recommend the

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[1] In the junction of triangulations of Spain and Algiers the greatest side is about 270 kilometres.

[2] "Comptes Rendus," 1880, vol. xc. pp. 637 and 1246.
"Sur l'Origine du Monde." Pp. 257. (Paris: Gauthier-Villars, 1880.)
"Annuaire pour l'an 1885, Bureau des Longitudes." Pp. 757-804. (Gauthier-Villars)

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